Non-specific pain

Intervention trials on upper body pain among computer operators

J H Andersen

Commentary on the paper by Rempel *et al* (see page 300)

Computer work is now one of the most widespread work tasks in the world. In some western countries more than half of the workforce use a computer station for more than half of their working day. Adverse effects of the computer could thus have a large impact on public health, even if effect sizes are small. Most concern has been expressed about pain and disorders of the musculoskeletal system in those using the keyboard for data entry and other keying tasks, and in the use of the computer mouse and other input devices.[1]

Concern about non-specific neck and arm pain is not new but has existed for centuries, various terms being used at different times according to the suspected causal exposures and affected populations (for example, writers' cramp, telegraphists' cramp).[2] At the present time, however, no well established and clinically accepted diseases of the musculoskeletal system have been ascribed with certainty to computer use. On the contrary, several large epidemiological studies encompassing clinical assessments have not found the prevalence or incidence of specific musculoskeletal disorders to be higher than in the general population.[3–9] Nevertheless, many workers and researchers regard upper body pain as a work related problem of computer users, and interest in the media has been huge. Belief in a pain syndrome ascribed to computer use is widely shared.

The modern solution is ergonomics—the classical approach of adjusting the workstation to the worker. Nowadays this is a large and expensive industry, but without much scientific evidence to define the ''correct'' or optimal workstation. Intervention studies with several different focuses have been performed over the past 10–15 years to develop an evidence base. In this issue of the journal, Rempel *et al*[10] report on an intervention study among 182 customer service operators in a one year randomised controlled study with four experimental arms. The intervention consisted of training and the introduction of trackballs and forearm support. The outcomes were weekly pain scores, and diagnoses of incident musculoskeletal disorders in the neck and upper extremities. The main finding regarding pain severity was that the armboard intervention was associated with a significant mean reduction in pain of 0.48 points on a 0–10 point scale.

Could such a reduction be described in a qualitative way, such as a reduction from ''some pain'' to ''minor pain'', or from ''severe pain'' to ''some pain''? I think not: it is difficult to give some meaningful expression to this small change, from an overall mean pain level of around 2–3 to 2 or a little less. Despite this reservation, a significant proportion of participants also rated their experience of pain as decreased. However, I would have preferred the outcome of interest to be a well defined and clinically important decrease in pain score (for example, a decrease of at least 2 points). The clinical assessment also revealed a protective effect for the armboards, with a reduction of the hazard rate of incident neck-shoulder disorders to 0.49, which means a reduction by approximately half. Surprisingly, the authors found as many as 22 new cases of shoulder tendonitis, corresponding to an incidence of more than 10%. In two other studies, the incidence of this outcome was much lower: 1.3%[4] and less than 0.1%[7] respectively. In all three studies, diagnosis required the symptom of shoulder pain and the semi-objective examination sign of pain on resisted movements, but the example of these three studies illustrates one of the major problems in epidemiological surveys of musculoskeletal pain: all too often the diagnostic criteria lack a solid foundation in terms of validity or reliability. Shoulder tendonitis is but one example. When it comes to the diagnosis of somatic pain syndrome and thoracic outlet syndrome, the confusion seems even more impressive. In general, much more work should be encouraged to improve case definitions for epidemiological purposes.

Recently, another randomised controlled trial of postural interventions for prevention of musculoskeletal symptoms among computer users was performed and the findings published in this journal.[11] Gerr *et al* found no differences in risk of musculoskeletal symptoms among 376 participants randomly assigned to two workstation and postural interventions in comparison to no workstation or postural intervention. Meanwhile, in another intervention study, Aarås *et al* found a reduction in shoulder pain in parallel with a reduction in trapezius load in a small group of female data dialogue workers after instituting a training programme and providing more ergonomic information.[12] However, the results are difficult to interpret due to the small sample size and lack of information on study eligibility.

More research is needed. In the meantime, what should health and safety practitioners do? Given the limitations of our current knowledge I find it difficult to make recommendations regarding postural or other specific adjustments of the workstation among computer users. Maybe the only recommendation should be that computer users should be satisfied with their workstation. Every reasonable effort should be made to give them the set-up they want. They should have the opportunity to influence their own work and how they perform it, including the right to make their workstation more comfortable or to use an armboard if they wish.

Occup Environ Med 2006;**63**:297–298.
doi: 10.1136/oem.2006.026450

Correspondence to: Dr J H Andersen, Herning Hospital G1, Landevej 61, Herning 7400, Denmark; hecjha@ringamt.dk

Competing interests: none declared

REFERENCES

1 **Punnett L**, Bergqvist U. Visual display unit work and upper extremity musculoskeletal disorders: a review of epidemiological findings. *Arbete och Halsa* 1997;**16**.
2 **Dembe AE**. *Occupation and disease. How social factors affect the conception of work-related disorders*. New Haven: Yale University Press, 1996.
3 **Bergqvist U**, Wolgast E, Nilsson B, *et al*. Musculoskeletal disorders among visual display terminal workers: individual, ergonomic, and work organizational factors. *Ergonomics* 1995;**4**:763–76.
4 **Gerr F**, Marcus M, Ensor C, *et al*. A prospective study of computer users: I. Study design and incidence of musculoskeletal symptoms and disorders. *Am J Ind Med* 2002;**41**:221–35.
5 **Andersen JH**, Thomsen JF, Overgaard E, *et al*. Computer use and carpal tunnel syndrome: a 1-year follow-up study. *JAMA* 2003;**289**:2963–9.
6 **Kryger AI**, Andresen JH, Lassen CF, *et al*. Does computer use pose an occupational hazard for forearm pain; from the NUDATA study. *Occup Environ Med* 2005;**60**:e14.
7 **Brandt LP**, Andersen JH, Lassen CF, *et al*. Neck and shoulder symptoms and disorders among

Danish computer workers. *Scand J Work Environ Health* 2004;**30**:399–409.
8 **Lassen CF**, Mikkelsen S, Kryger AI, *et al*. Elbow and wrist/hand symptoms among 6,943 computer operators: a 1-year follow-up study (the NUDATA study). *Am J Ind Med* 2004;**46**:521–33.
9 **Tornqvist EW**, Kilbom Å, Vingård E, *et al*. The influence on seeking care because of neck and shoulder disorders from work-related exposures. *Epidemiology* 2001;**12**:537–45.
10 **Rempel DM**, Krause N, Goldberg R, *et al*. A randomised controlled trial evaluating the effects of two workstation interventions on upper body pain and incident musculoskeletal disorders among computer operators. *Occup Environ Med* 2006;**63**:300–6.
11 **Gerr F**, Marcus M, Monteilh C, *et al*. A randomised controlled trial of postural interventions for prevention of musculoskeletal symptoms among computer users. *Occup Environ Med* 2005;**62**:478–87.
12 **Aarås A**, Horgen G, Ro O, *et al*. The effect of an ergonomic intervention on musculoskeletal, psychosocial and visual strain of VDT data entry work: the Norwegian part of the international study. *Int J Occup Safety Ergon* 2005;**11**:25–47.

Mobile phones

Health risks from mobile phone base stations

D Coggon

Commentary on the paper by Hutter *et al* (see page 307)

Concerns about possible adverse health effects of mobile telephony have focused mainly on the risk of brain tumours in users of mobile phones, but other types of illness have also been linked with the technology. In particular, several epidemiological surveys have suggested associations with non-specific complaints such as headache, tiredness, sleep disturbance, loss of memory, and dizziness. These findings, which echo reports of illness associated with other types of radiofrequency (RF) radiation,[1] relate not only to use of mobile phones,[2–4] but also to residence near to mobile phone base stations.[5]

Further evidence on the latter is provided in a paper by Hutter *et al* in this issue.[6] They found that symptoms such as headache, fatigue, and difficulty in concentration were more common in people with higher potential exposures to radiation from nearby base stations, and that the association remained significant after adjustment for various possible confounding factors, including regular personal use of mobile phones.

Given these new findings, how strong is the evidence that residential proximity to mobile phone base stations causes illness, and if it does, what is the underlying mechanism?

A weakness of earlier studies was that both exposure and symptoms were ascertained by questioning participants. As a consequence, risk estimates may have been inflated through biased recall. The study by Hutter *et al* avoided this problem by estimating exposures from measurements of RF fields in subjects' bedrooms. The method was still not ideal. For practical reasons, measurements could only be short term, and may not have captured the full range of temporal variation at the monitoring site. Moreover, participants spent only part of their time at home, and their exposures at other locations may have been quite different. In general, however, the effects of any resultant misclassification of exposures would be to bias risk estimates towards the null, and not to give spurious associations.

A more important limitation, given the large number of health outcomes examined in the study, is the possibility that some associations occurred by chance. Concerns about this are reduced insofar as positive associations were observed with many of the symptoms examined. However, further confirmation is needed before an elevated risk of such symptoms can be regarded as established.

Even if there were a true association, it would not necessarily imply a toxic effect of RF radiation. Currently there is no known biophysical mechanism by which low level exposures could cause toxicity in a substantial proportion of the general population (the excess prevalence of many symptoms in the Hutter *et al* study was more than 15%), when the same symptoms do not appear to be a problem in many people who regularly use mobile phones for prolonged periods with exposures to the head that are orders of magnitude higher. An alternative possibility is that illness occurs as a psychologically mediated response to a perceived hazardous exposure. In this respect, it is notable that similar symptoms have also been reported in relation to a diverse range of chemical exposures, again without any demonstrable underlying toxicological mechanism.[7]

Hutter and colleagues tried to address this possibility by adjusting risk estimates for individual beliefs about health risks from base stations, but the fact that associations persisted after this adjustment does not exclude a psychological origin for the symptoms. To give an extreme example, if everyone in the study had identical beliefs, the adjustment would have no impact on risk estimates whatsoever, but risk could still depend importantly on people's beliefs and expectations.

Another way to explore pathogenesis is by testing the effects of exposure experimentally in blinded subjects, an approach that will be valid provided that effects are relatively immediate and do not persist for a long time after last exposure. One such study found a significant reduction in wellbeing with exposure to RF fields similar to those produced by a UMTS (universal mobile telecommunications system) base station, both in subjects who had previously indicated symptoms that they attributed to base stations, and also in healthy volunteers.[8] However, there was no parallel effect from GSM (global system for mobile telecommunication) type fields, and in an earlier experiment by Hiatenen and colleagues,[9] the incidence of symptoms in subjects who believed that they were sensitive to radiation from mobile phones was higher during periods of sham than of real exposure. Interpretation of these inconsistencies can only be resolved by further research.

Meanwhile, decisions on the siting of base stations must be made in a context of uncertainty. Hutter and colleagues propose that as a precautionary measure, base stations should be positioned in a way that minimises the exposure of neighbours, and this seems a sensible